FIG. 1

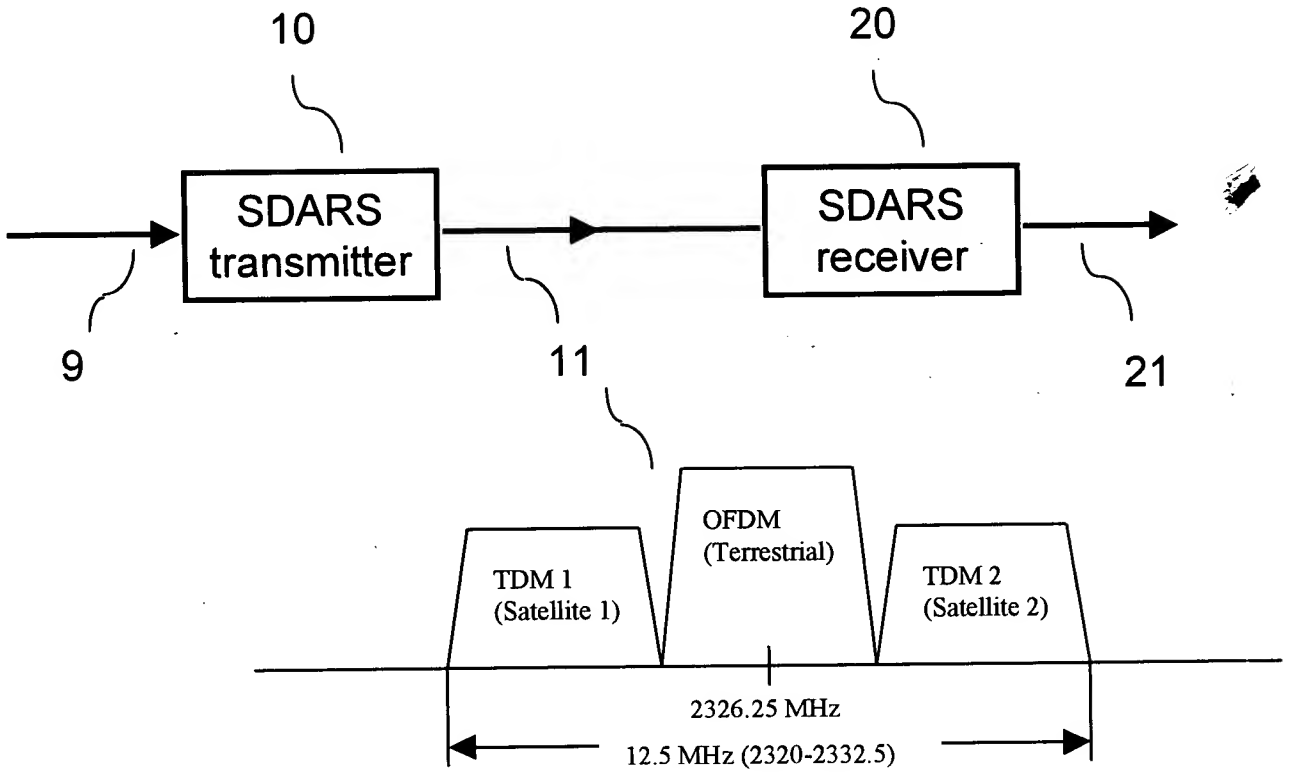


FIG. 2

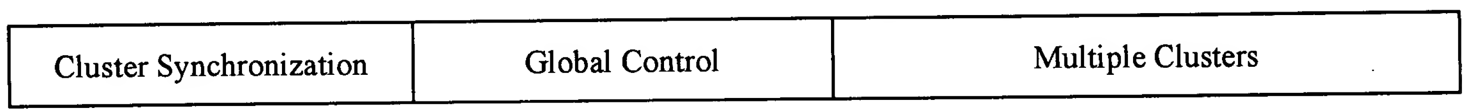

Cluster Synchronization
Global Control
Multiple Clusters

FIG. 3

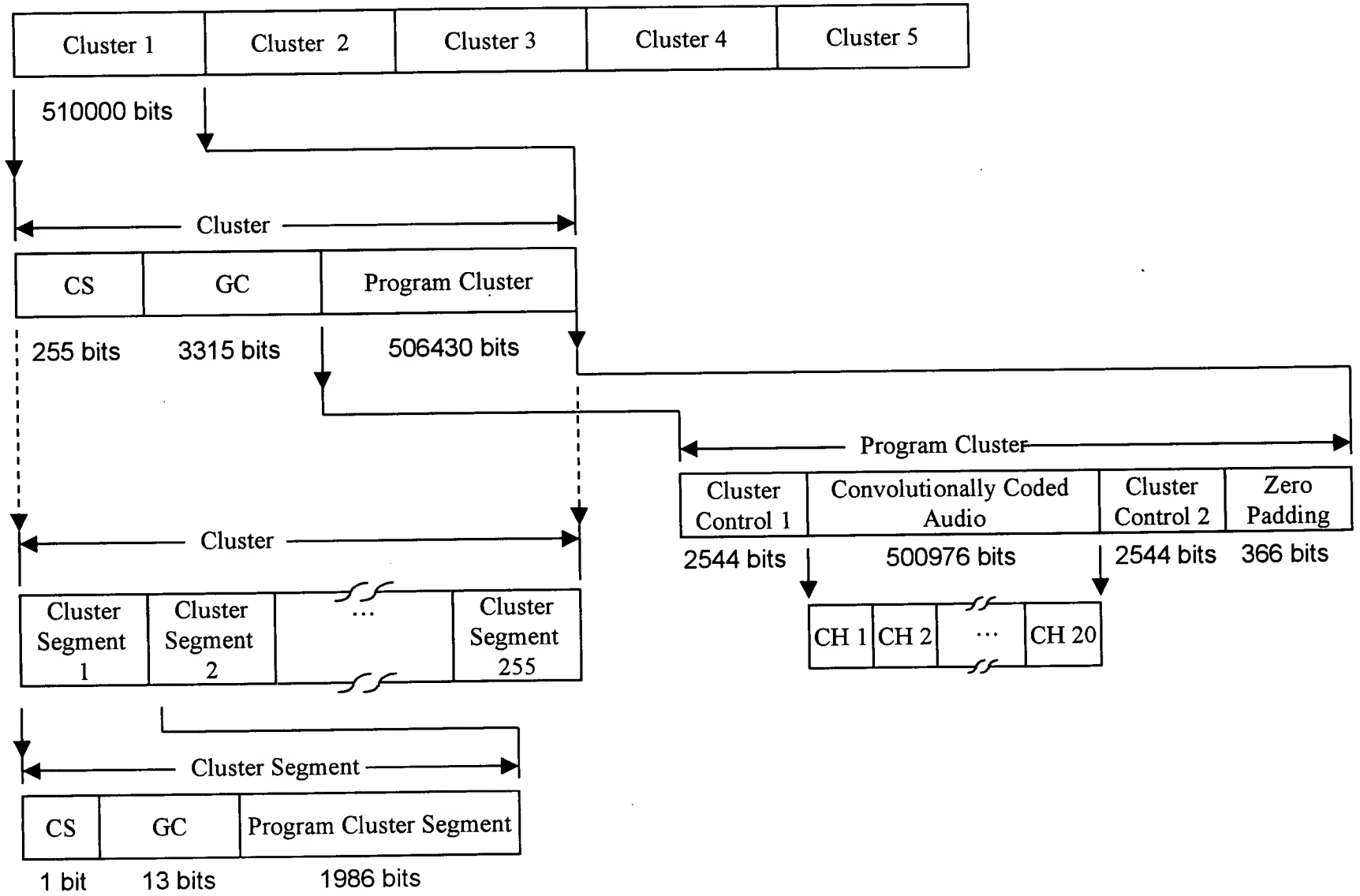

Cluster 1
Cluster 2
Cluster 3
Cluster 4
Cluster 5
510000 bits
Cluster
CS
GC
Program Cluster
255 bits
3315 bits
506430 bits
Program Cluster
Cluster Control 1
Convolutionally Coded Audio
Cluster Control 2
Zero Padding
2544 bits
500976 bits
2544 bits
366 bits
CH 1
CH 2
...
CH 20
Cluster
Cluster Segment 1
Cluster Segment 2
...
Cluster Segment 255
Cluster Segment
CS
GC
Program Cluster Segment
1 bit
13 bits
1986 bits

FIG. 4

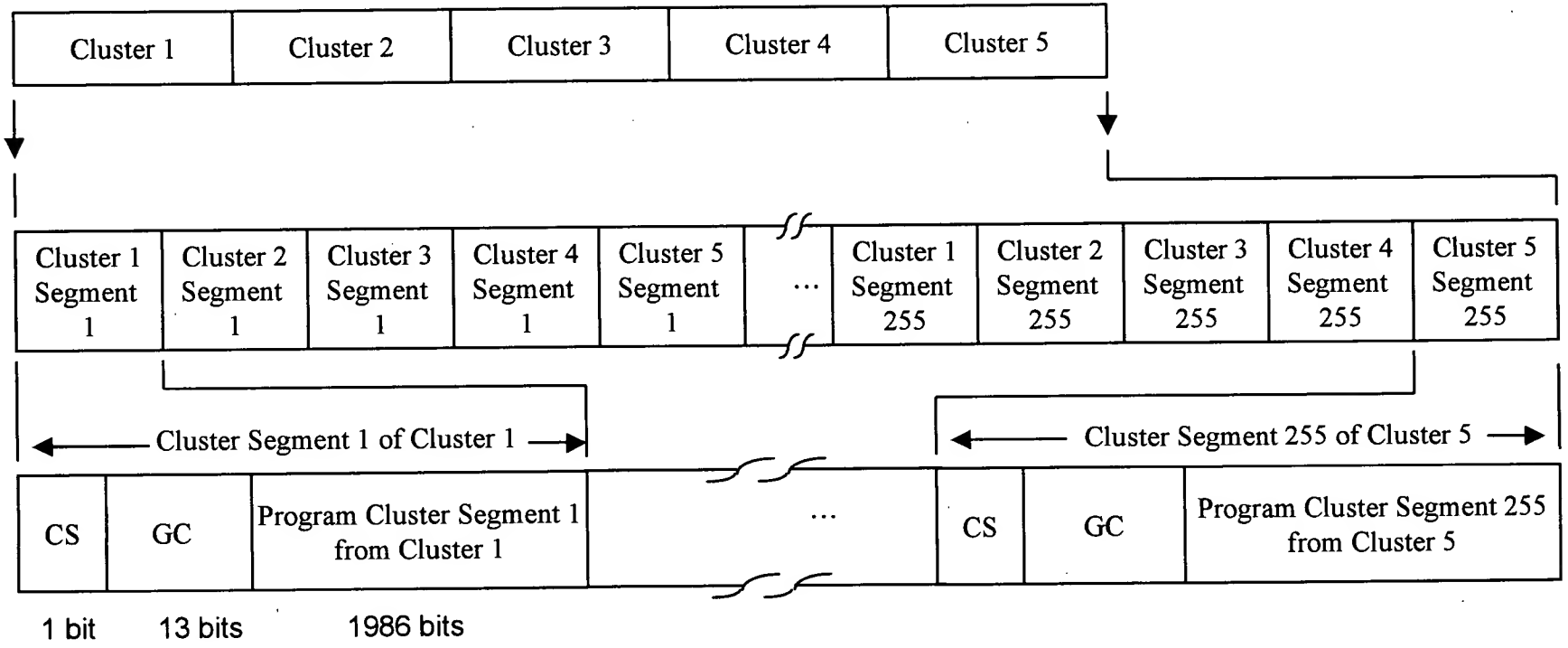

Cluster 1
Cluster 2
Cluster 3
Cluster 4
Cluster 5
Cluster 1 Segment 1
Cluster 2 Segment 1
Cluster 3 Segment 1
Cluster 4 Segment 1
Cluster 5 Segment 1
...
Cluster 1 Segment 255
Cluster 2 Segment 255
Cluster 3 Segment 255
Cluster 4 Segment 255
Cluster 5 Segment 255
Cluster Segment 1 of Cluster 1
Cluster Segment 255 of Cluster 5
CS
GC
Program Cluster Segment 1 from Cluster 1
...
CS
GC
Program Cluster Segment 255 from Cluster 5
1 bit
13 bits
1986 bits

FIG. 5

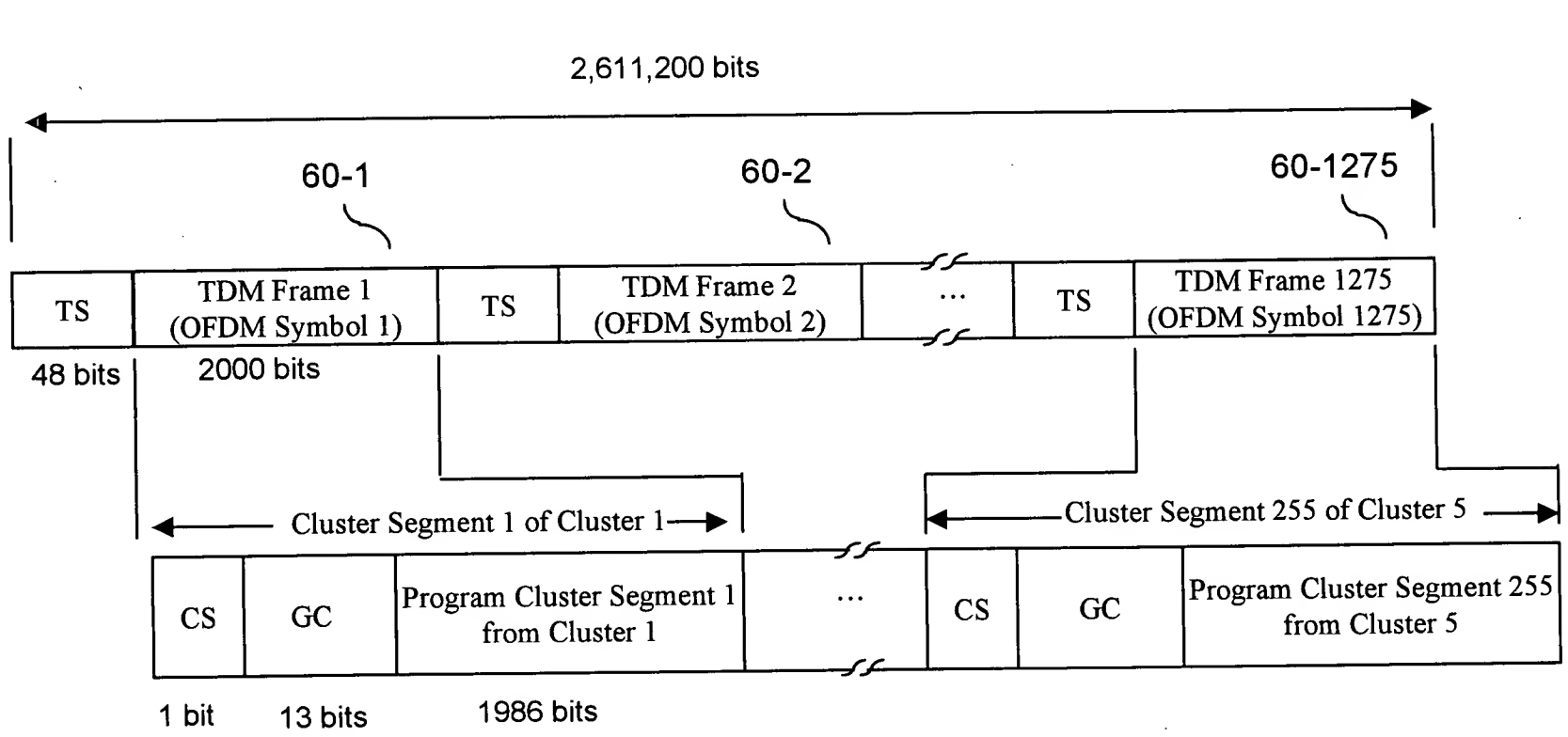
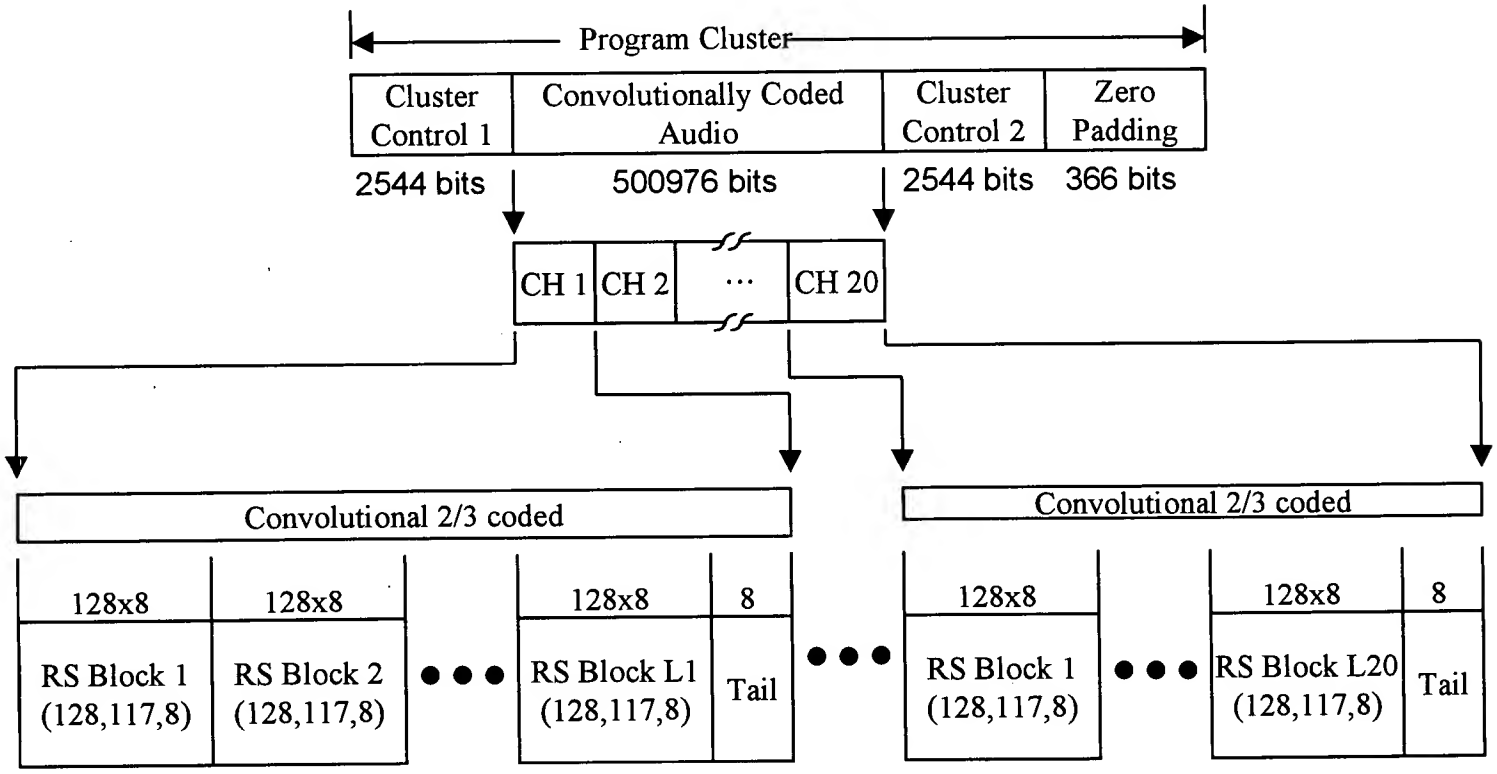


FIG. 6



L1 + L2 + L3 + … + L20 = 326 RS Blocks/Program Cluster,

where, Li = Number of RS blocks for Channel i, $1 \le i \le 20$

the number of RS blocks per channel, Li, is a random variable,
each RS word comprises 8 bits,
concatenated with a 2/3 convolutional encoder,
for each channel, there is a tail comprising 8 bits,

FIG. 7

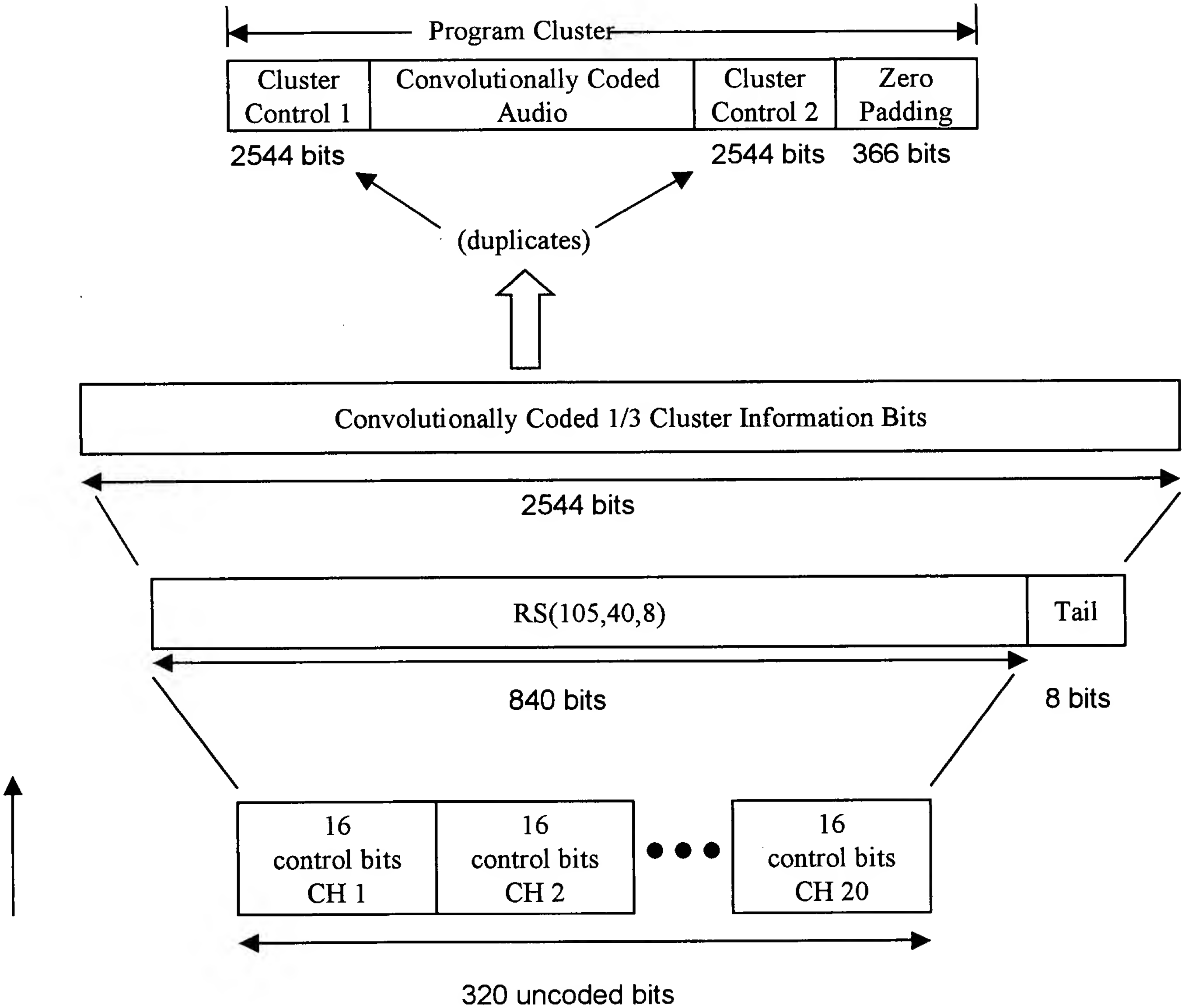

Program Cluster
Cluster Control 1
Convolutionally Coded Audio
Cluster Control 2
Zero Padding
2544 bits
2544 bits
366 bits
(duplicates)
Convolutionally Coded 1/3 Cluster Information Bits
2544 bits
RS(105,40,8)
Tail
840 bits
8 bits
16 control bits CH 1
16 control bits CH 2
16 control bits CH 20
320 uncoded bits

FIG. 8

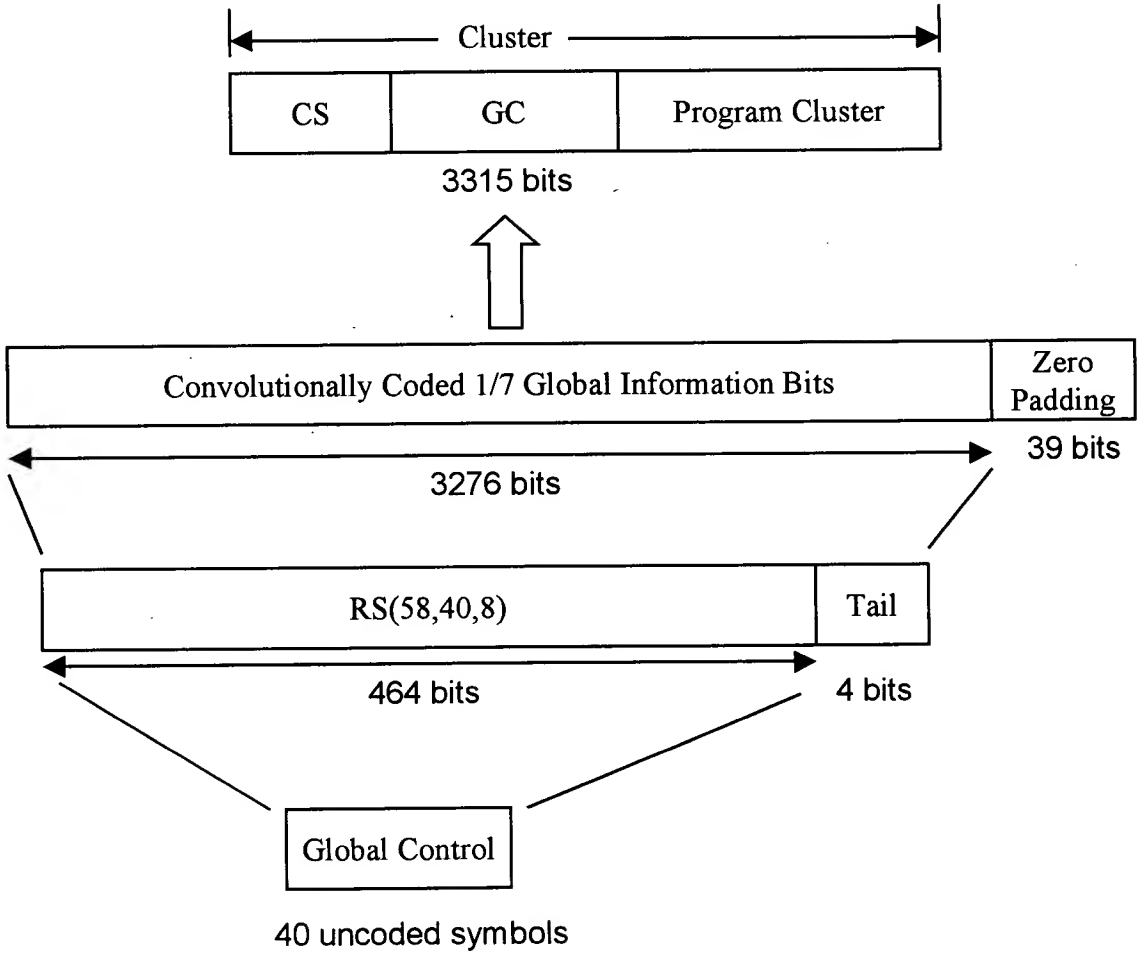

Cluster
CS
GC
Program Cluster
3315 bits
Convolutionally Coded 1/7 Global Information Bits
Zero Padding
39 bits
3276 bits
RS(58,40,8)
Tail
464 bits
4 bits
Global Control
40 uncoded symbols

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FIG. 9

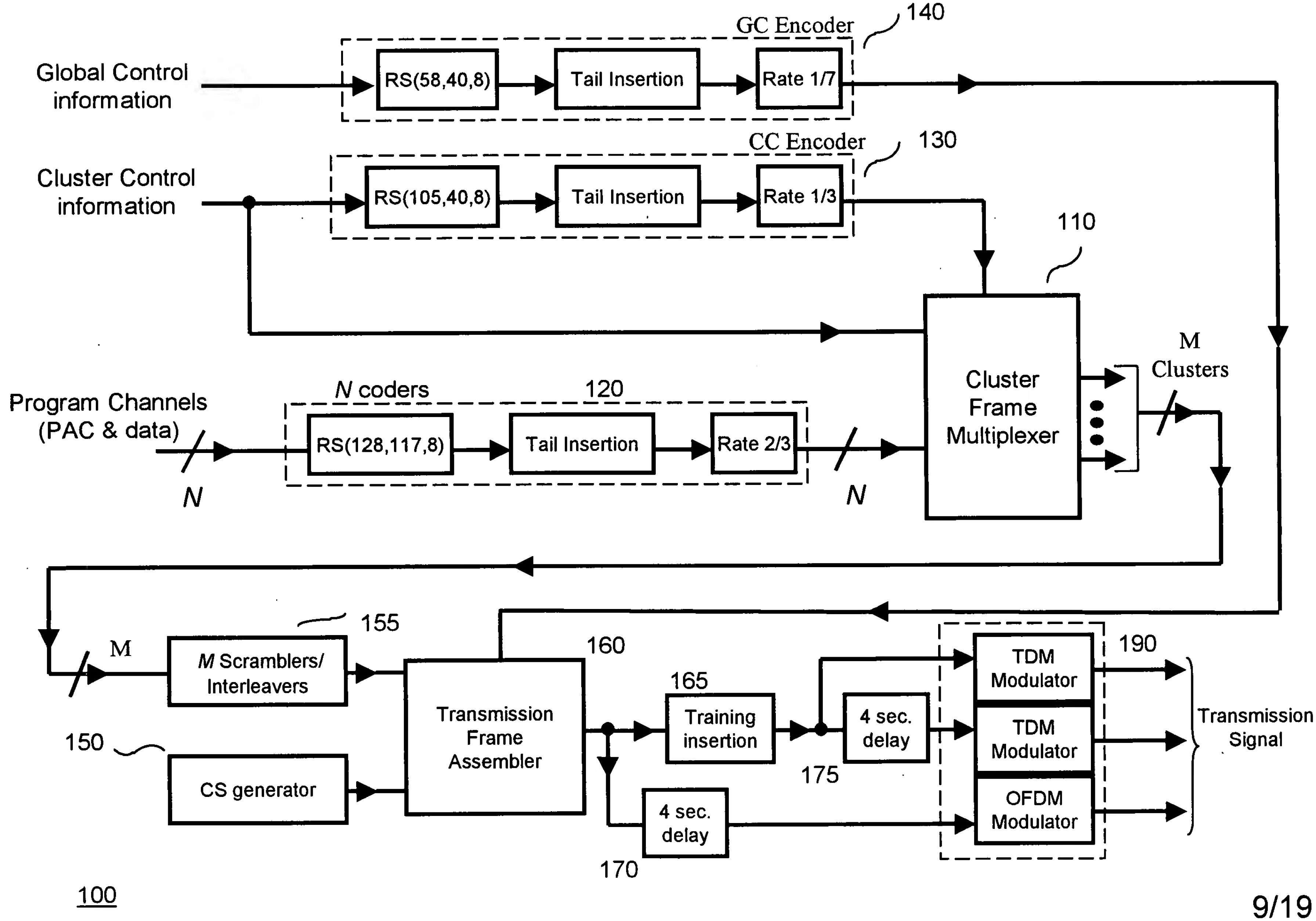
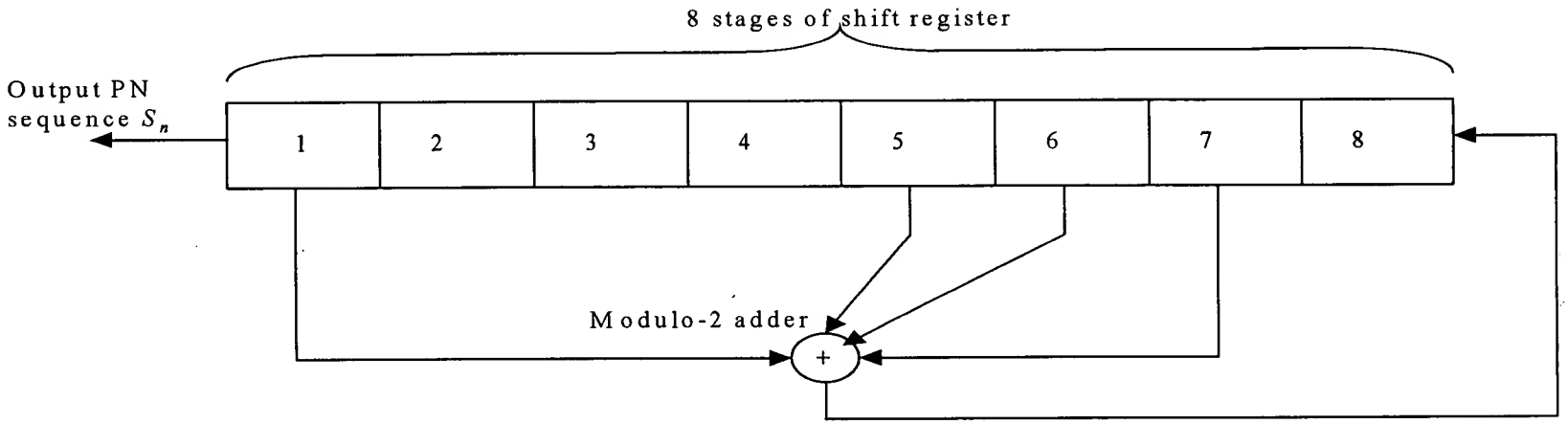
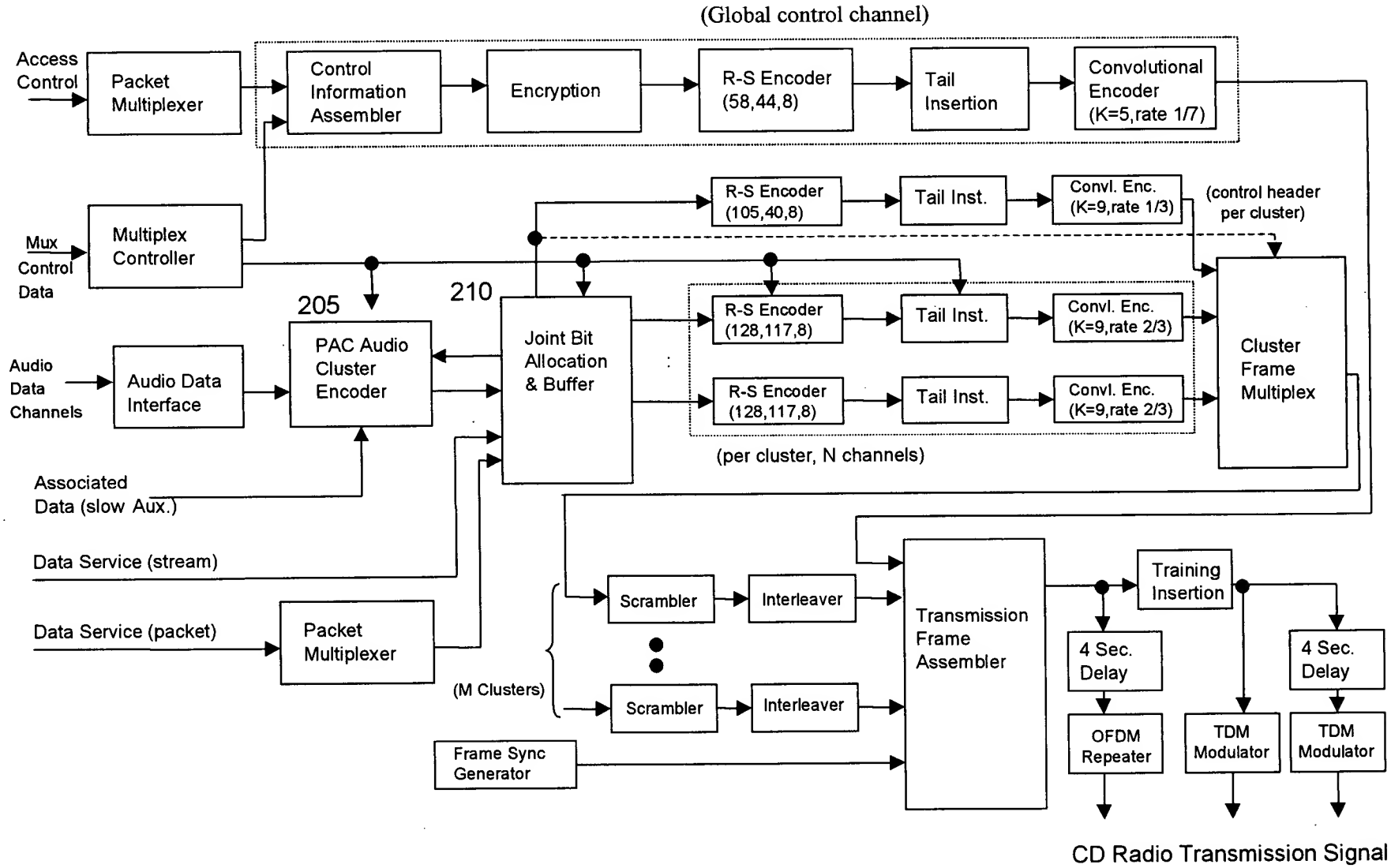


FIG. 10


8 stages of shift register
Output PN sequence S_n
1
2
3
4
5
6
7
8
Modulo-2 adder
+

150

FIG. 11


(Global control channel)
Access Control
Packet Multiplexer
Control Information Assembler
Encryption
R-S Encoder (58,44,8)
Tail Insertion
Convolutional Encoder (K=5,rate 1/7)
Mux Control Data
Multiplex Controller
R-S Encoder (105,40,8)
Tail Inst.
Convl. Enc. (K=9,rate 1/3)
(control header per cluster)
205
210
Audio Data Channels
Audio Data Interface
PAC Audio Cluster Encoder
Joint Bit Allocation & Buffer
R-S Encoder (128,117,8)
Tail Inst.
Convl. Enc. (K=9,rate 2/3)
R-S Encoder (128,117,8)
Tail Inst.
Convl. Enc. (K=9,rate 2/3)
(per cluster, N channels)
Cluster Frame Multiplex
Associated Data (slow Aux.)
Data Service (stream)
Data Service (packet)
Packet Multiplexer
(M Clusters)
Scrambler
Interleaver
Scrambler
Interleaver
Transmission Frame Assembler
Training Insertion
4 Sec. Delay
OFDM Repeater
TDM Modulator
4 Sec. Delay
TDM Modulator
Frame Sync Generator
CD Radio Transmission Signal

200

FIG. 12

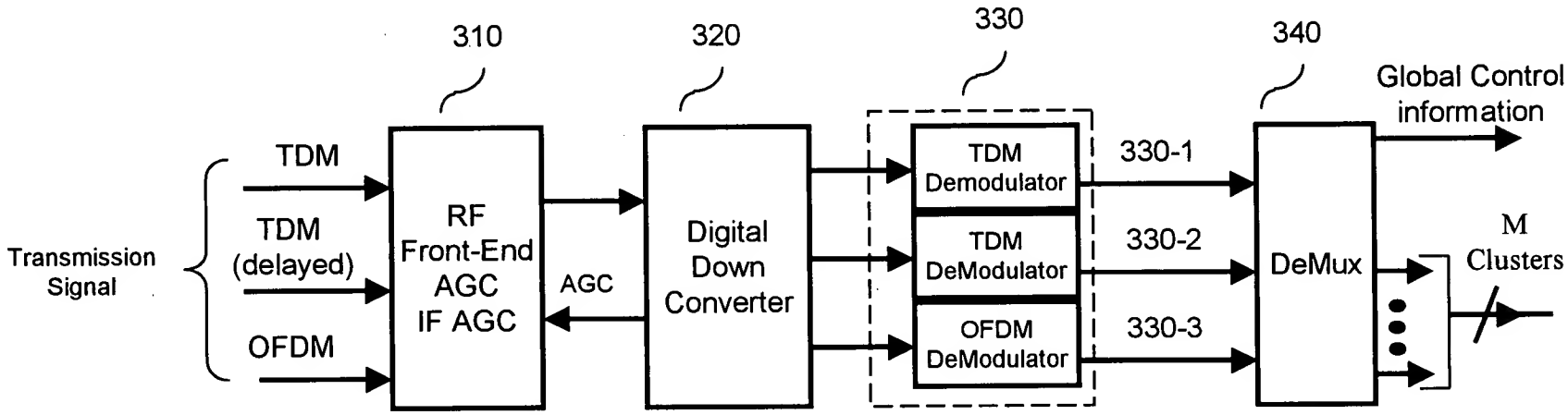

300
310
320
330
340
Global Control information
TDM
TDM (delayed)
OFDM
Transmission Signal
RF Front-End AGC IF AGC
AGC
Digital Down Converter
TDM Demodulator
TDM DeModulator
OFDM DeModulator
330-1
330-2
330-3
DeMux
M Clusters

FIG. 13

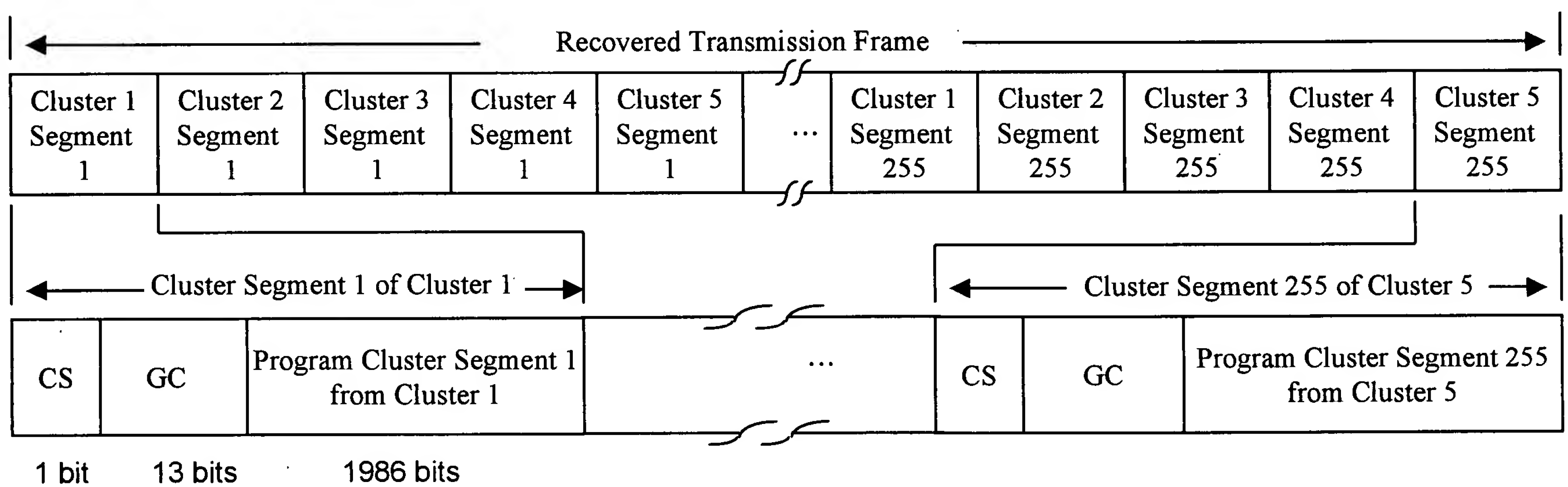

Recovered Transmission Frame
Cluster 1 Segment 1
Cluster 2 Segment 1
Cluster 3 Segment 1
Cluster 4 Segment 1
Cluster 5 Segment 1
...
Cluster 1 Segment 255
Cluster 2 Segment 255
Cluster 3 Segment 255
Cluster 4 Segment 255
Cluster 5 Segment 255
Cluster Segment 1 of Cluster 1
Cluster Segment 255 of Cluster 5
CS
GC
Program Cluster Segment 1 from Cluster 1
...
CS
GC
Program Cluster Segment 255 from Cluster 5
1 bit
13 bits
1986 bits

FIG. 14

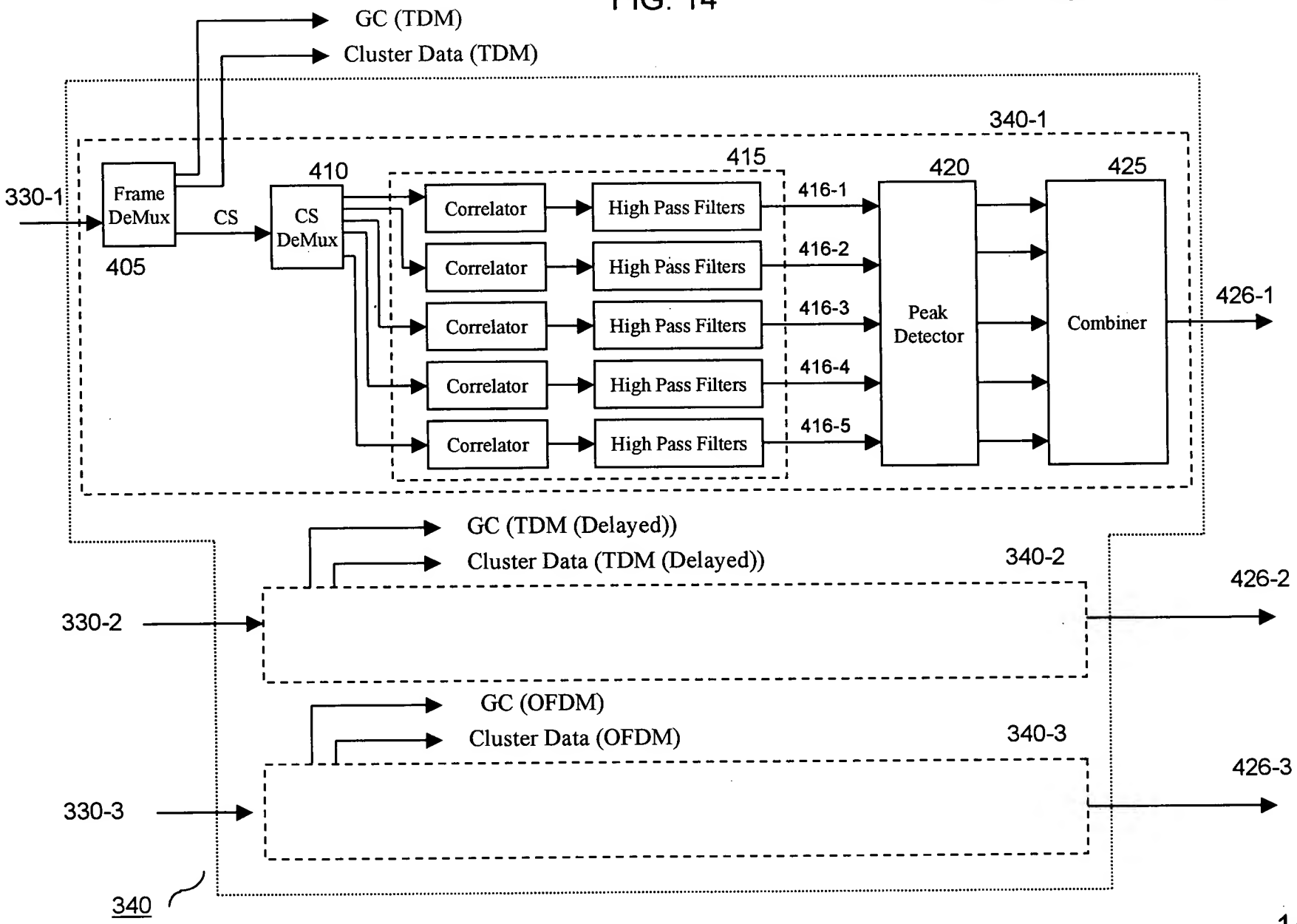

GC (TDM)
Cluster Data (TDM)
340-1
330-1
Frame DeMux
405
CS
410
CS DeMux
415
Correlator
High Pass Filters
416-1
416-2
416-3
416-4
416-5
420
Peak Detector
425
Combiner
426-1
GC (TDM (Delayed))
Cluster Data (TDM (Delayed))
340-2
330-2
426-2
GC (OFDM)
Cluster Data (OFDM)
340-3
330-3
426-3
340

FIG. 15

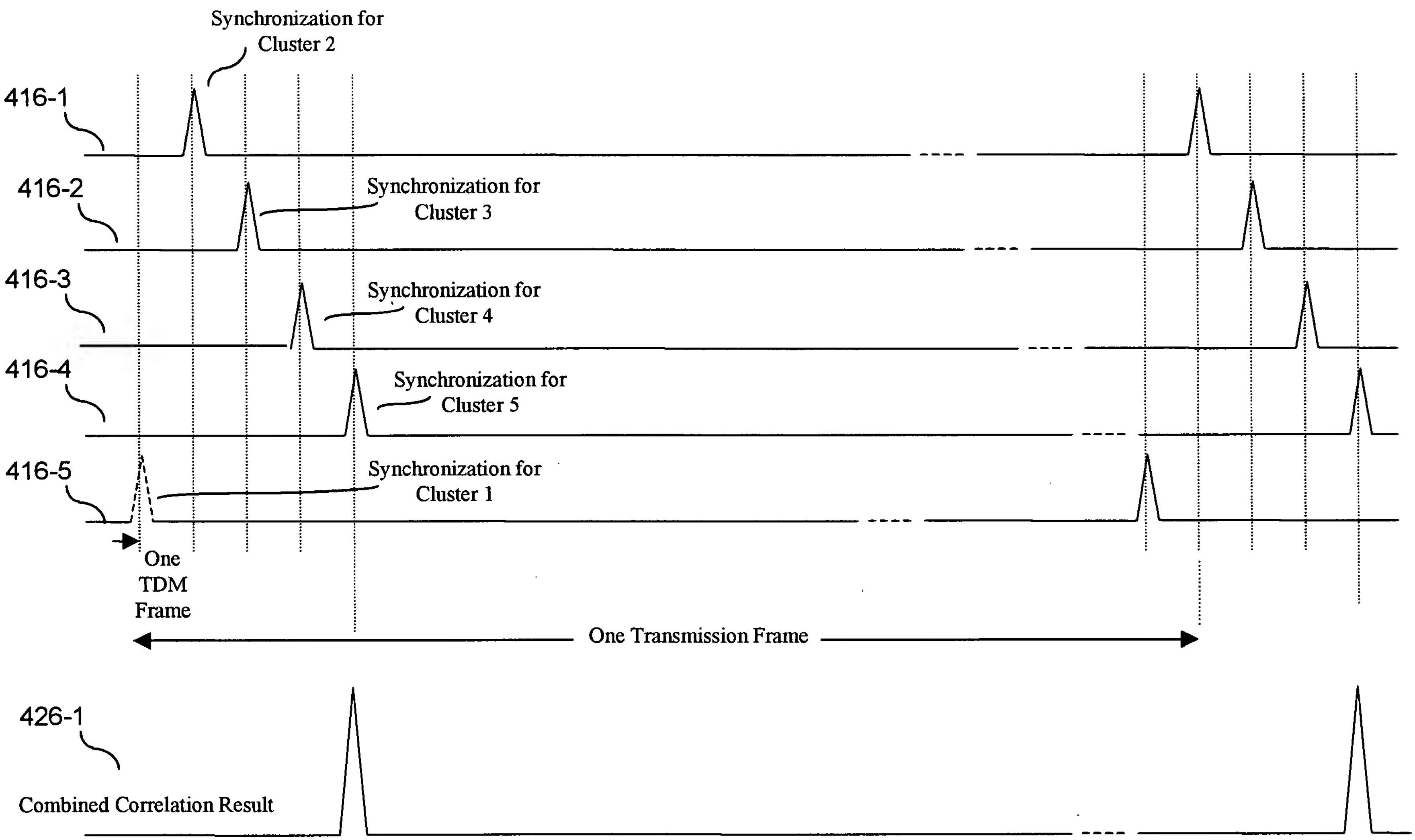
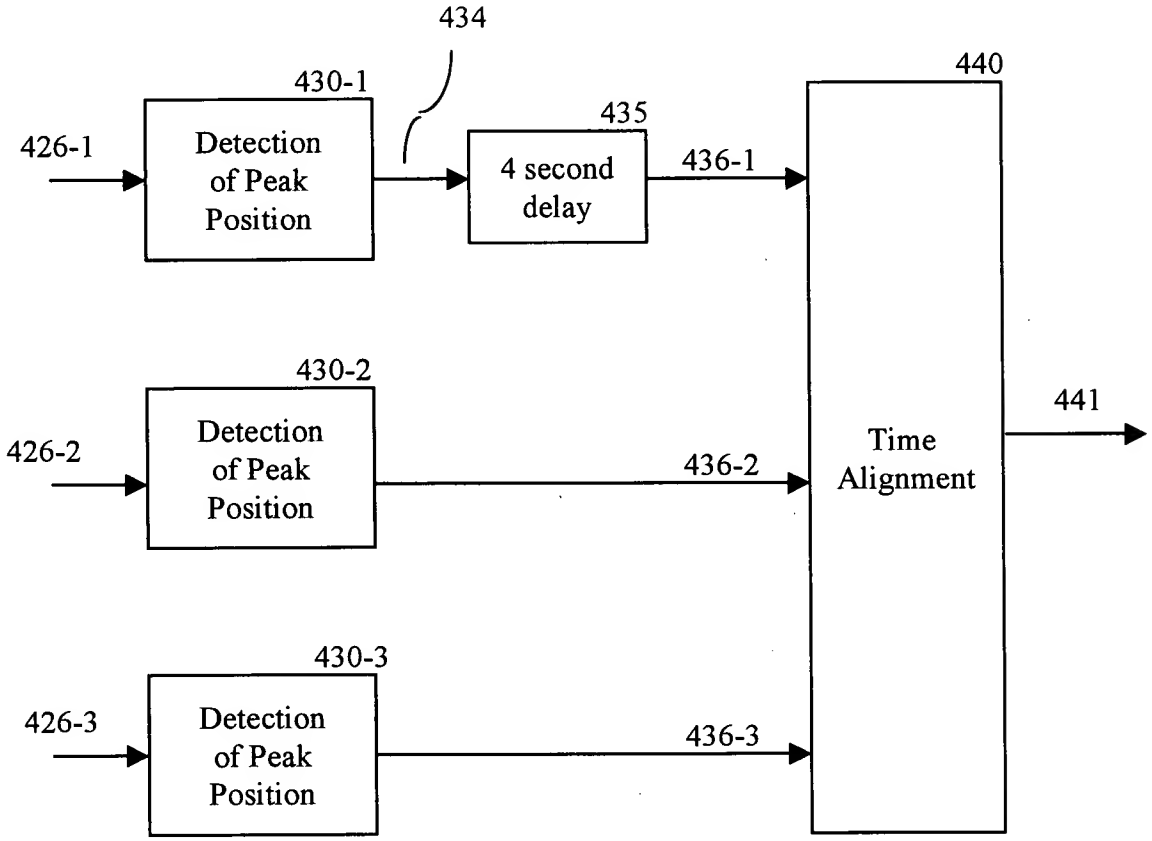
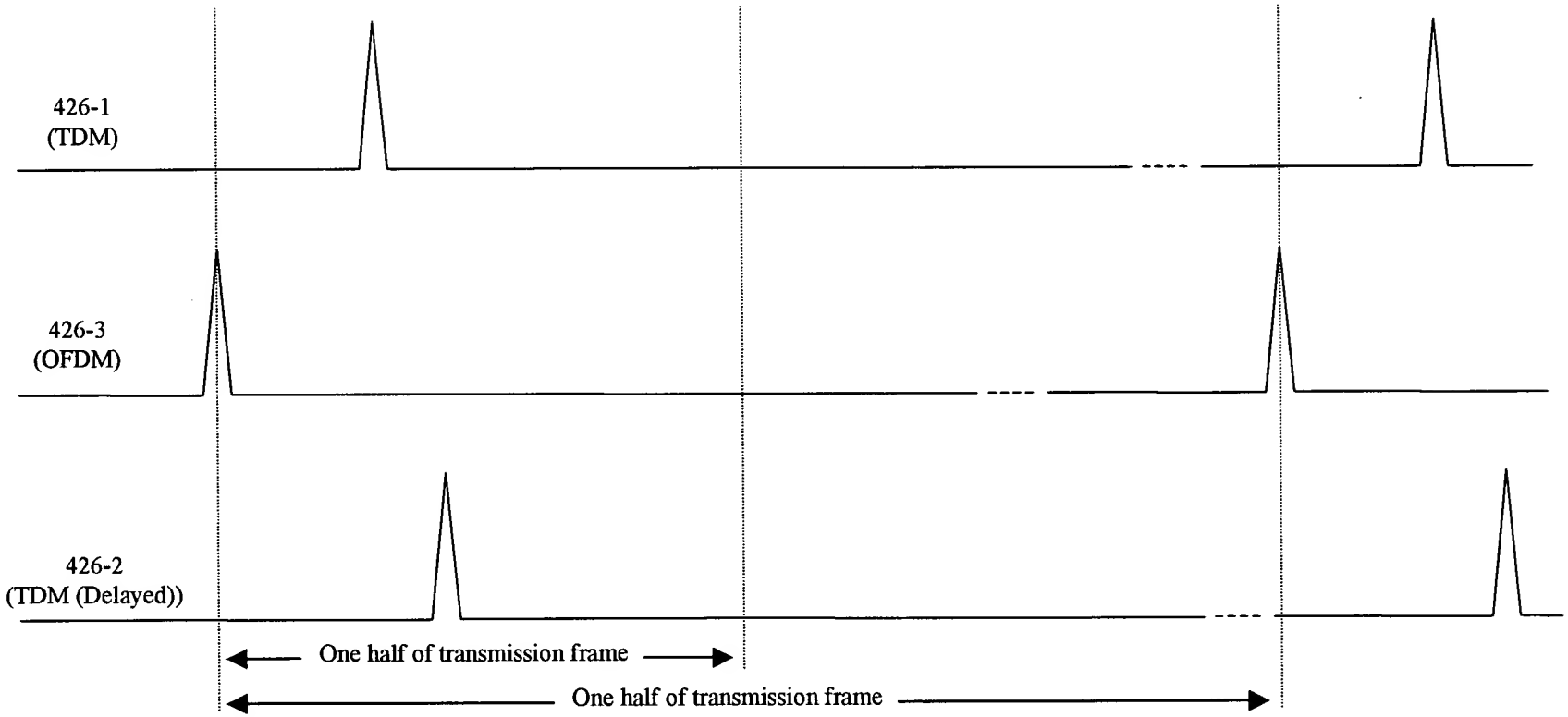

416-1
416-2
416-3
416-4
416-5
Synchronization for Cluster 2
Synchronization for Cluster 3
Synchronization for Cluster 4
Synchronization for Cluster 5
Synchronization for Cluster 1
One TDM Frame
One Transmission Frame
426-1
Combined Correlation Result

FIG. 16


434
430-1
440
435
426-1
Detection of Peak Position
4 second delay
436-1
430-2
426-2
Detection of Peak Position
436-2
Time Alignment
441
430-3
426-3
Detection of Peak Position
436-3

340

FIG. 17



Note: If differential channel delays are ensure within one half of transmission frame, then cluster synchronization can align three paths in time without ambiguity

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FIG. 18

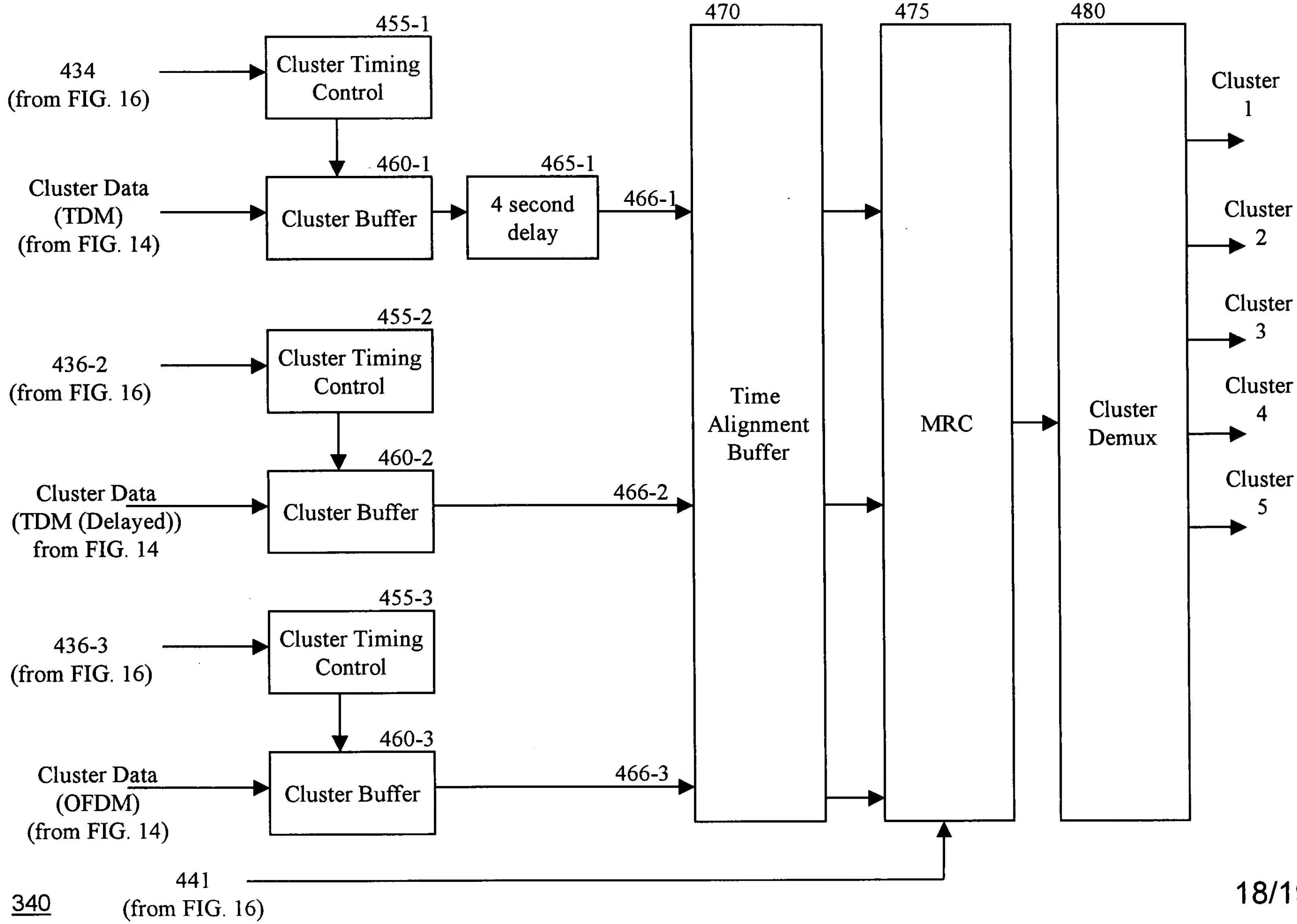
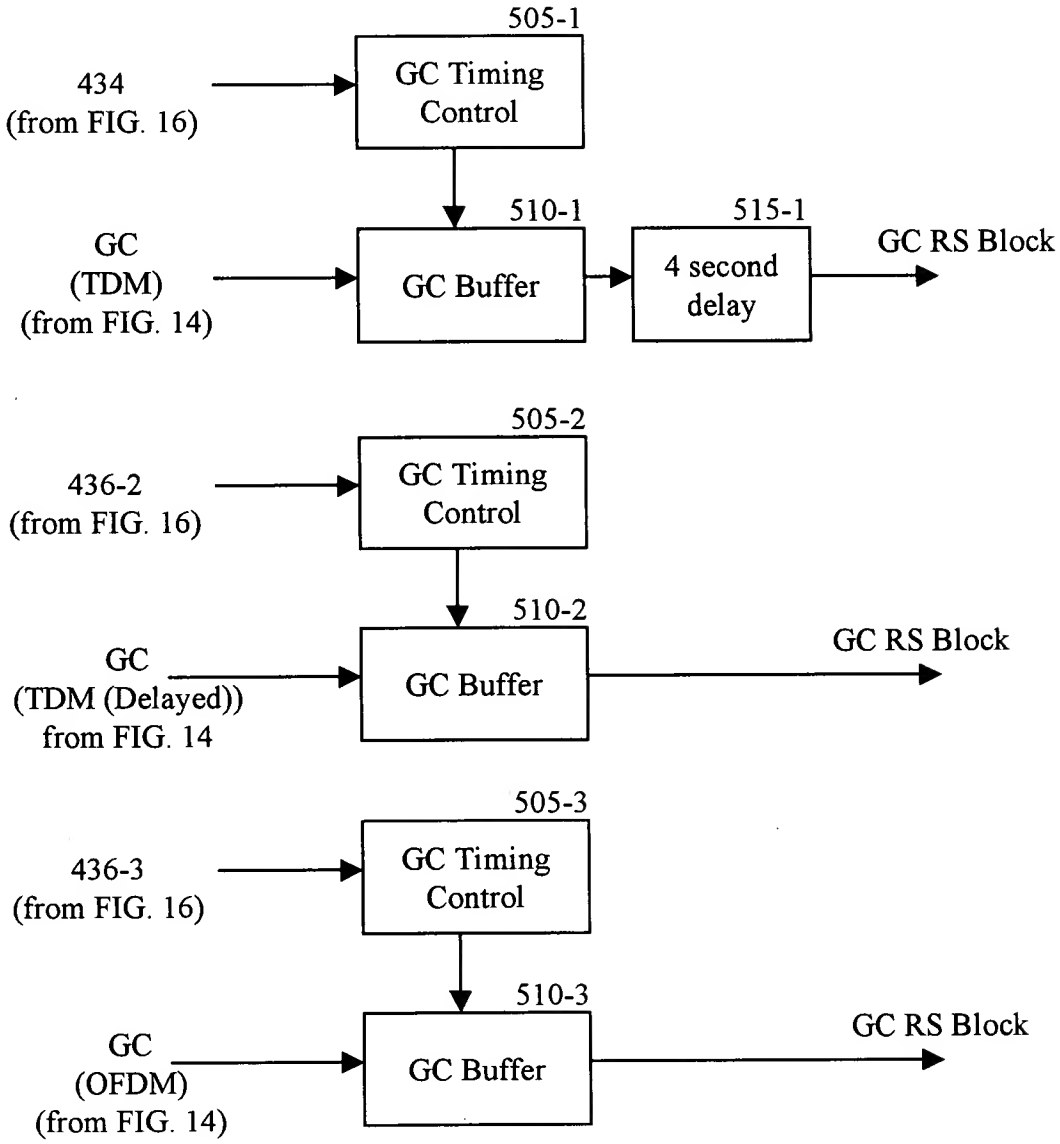


FIG. 19


505-1
434
(from FIG. 16)
GC Timing Control
510-1
515-1
GC
(TDM)
(from FIG. 14)
GC Buffer
4 second delay
GC RS Block
505-2
436-2
(from FIG. 16)
GC Timing Control
510-2
GC
(TDM (Delayed))
from FIG. 14
GC Buffer
GC RS Block
505-3
436-3
(from FIG. 16)
GC Timing Control
510-3
GC
(OFDM)
(from FIG. 14)
GC Buffer
GC RS Block

340